

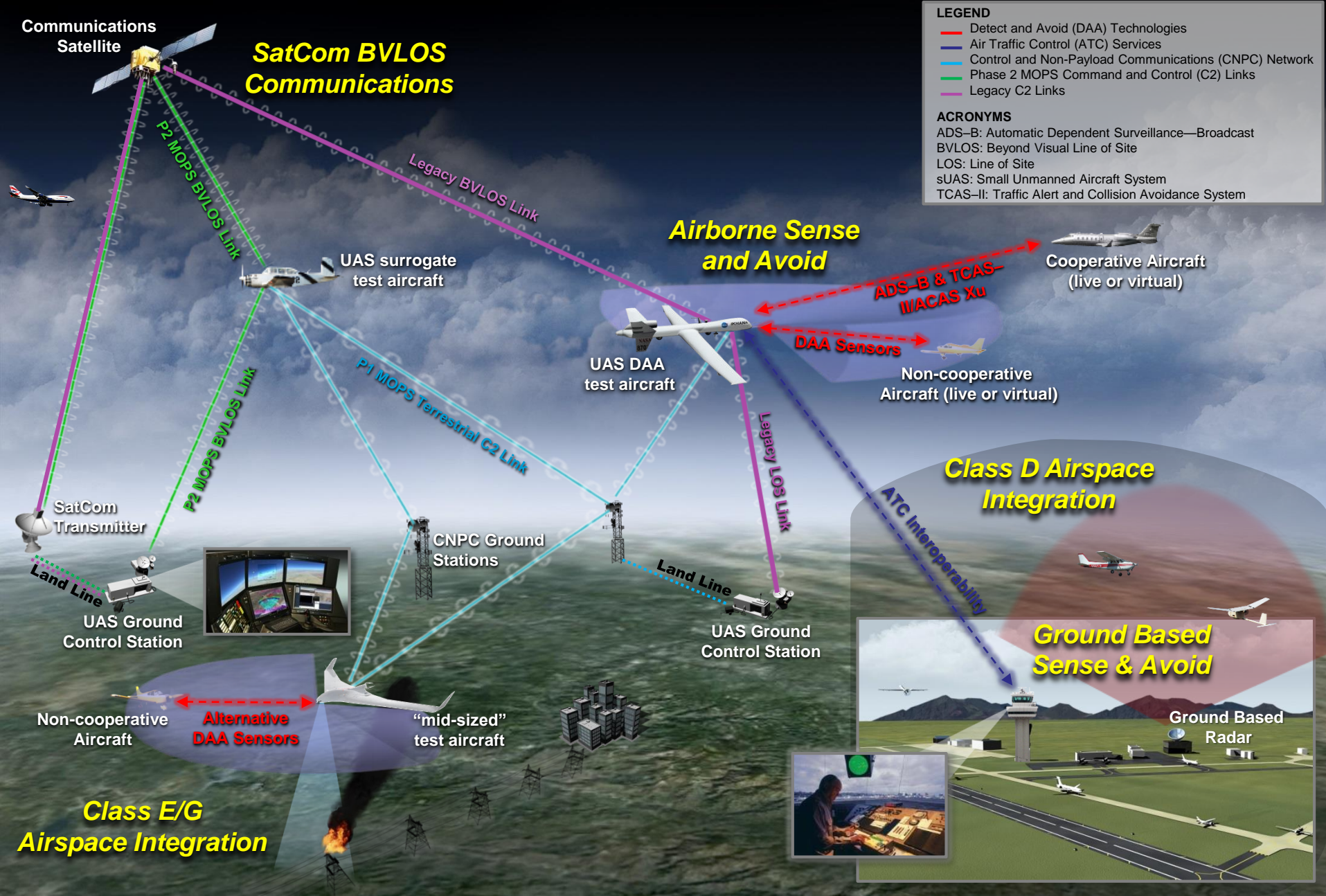
Possible P2 MOPS TOR Overview



- UAS-NAS Phase 2 MOPS will focus on development of more broadly applicable Detect and Avoid (DAA) systems, and establishment of Satellite Communication systems
- DAA performance standards for concepts and equipment to support UAS integration when the UAS performing extended operations within Class D, G, and E airspace
 - Extended BLOS operations will require technologies and performance standards that include a variety of airborne sensors (e.g EO/IR, Lidar, GBSAA, etc) that accommodate a more diverse set of UAS vehicles and DAA architectures (e.g. SatCom, and automation)
 - Class D terminal operations will require technologies and performance standards that extend P1 MOPS capabilities to the ground level, and define new manned/unmanned interoperability concepts
 - Likely to leverage P1 C2 MOPS technologies
- SatCom performance standards for the C2 Data Link in allocated spectrum (Ku/Ka-Band and C-Band)
 - Develop civil UAS airborne and earth stations to enable testing in proposed Ku/Ka-Band satellite spectrum bands.
 - Perform testing of satellite-based Control and Non-Payload Communications (CNPC) with existing satellites operating in Fixed Satellite Service frequency bands
 - Development of strategies and concepts necessary for C-Band SatCom

Phase 2 MOPS TOR OV-1

National Aeronautics and
Space Administration



P2 MOPS Proposed Key Deliverables



FY2017:

- Closeout of Phase 1 MOPS and Technology Transfer
- Input to the SC-228 P2 MOPS White Paper

FY2018:

- Development of MOPS content

FY2019:

- Input to the SC-228 P2 Preliminary MOPS

FY2020:

- Input to the SC-228 P2 Final MOPS

Potential DAA Scope



Performance standards for a broad range of civil UAS capable of operations Beyond Visual Line of Sight (BVLOS). in Class D, E, and G airspace

- Operations within a terminal environment should be considered to include; Class D airspace, towered airfields within Class E airspace, non-towered airfields within Class E airspace, non-towered airfields within Class G airspace, and off-airfield launch and recovery sites within Class G airspace (e.g. GBSAA)
- Technologies and sensors to enable UAS with less available Size, Weight, and Power (SWaP) should be considered (“mid-sized” UAS
- Very Low Level (VLL) operations, which includes extended operations below 500 ft AGL, are not in scope of Phase Two DAA MOPS.
- A collision avoidance capability (e.g. ACAS Xu) that operates in the absence of a C2 Datalink will be included as part of the DAA equipment.
- Ground operations by UAS are not in scope of Phase Two DAA MOPS.
- In order to meet the schedules this Terms of Reference specifies, appropriate and continued focusing of DAA Working Group activities will be required. Multiple areas should be considered as part of the scope for Phase Two DAA MOPS as part of the White Paper development, including the DAA systems ability to:
 - Enable UAS to accept Visual Clearances in accordance with standard procedures in operating conditions where a manned aircraft would be reasonably expected to accept them .
 - Fly under Visual Flight Rules (VFR)

Potential C2 Scope



The focus of Phase Two activities will be on the use a satellite based Beyond Radio Line of Sight (BRLOS) C2 Data Link, primarily referred to as SATCOM. Below is additional guidance for Phase Two:

- If the International Telecommunications Union (ITU) World Radio Conference (WRC) 2015 allocates specific spectrum for Fix Satellite Service (FSS) for use by UAS for C2, SC-228 will prioritize the use of that spectrum.
- Phase Two C2 MOPS should enable world-wide operations, even if spectrum challenges have not been harmonized internationall.
- Inclusion of SATCOM architectures thae enable civil UAS airborne and earth stations in proposed Ku/Ka-Band satellite spectrum bands.
- Inclusion of SATCOM architectures that enable satellite-based Control and Non-Payload Communications (CNPC) with existing satellites operating in Fixed Satellite Service (FSS) frequency bands
- MASPS level development of design parameters and performance goals for C-Band satellite-based CNPC system in the existing Aeronautical Mobile-Satellite (R) Service [AMS(R)S] allocation in which no satellites currently operate.

Other P2 MOPS Discussion Points



Detect and Avoid

- Aircraft applicability (sUAS vs “mid-sized” or “light aircraft”)
- Low altitude airspace
- Class B and C airspace
- ACAS Xu and TCAS II
- Automation
- VFR and visual clearances
- Ground Operations

Command and Control

- SatCom positions at WRC15
- Networked Terrestrial Systems
- Cellular
- C2 and DAA performance trade space

Overall

- Timelines
- P3 MOPS scope?